UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/637,094	08/06/2003	Bruno Ghyselen	4717-6300	9064

28765 7590 10/31/2005		EXAMINER
WINSTON & STRAWN LLP		PHAM, THANH V

ART UNIT	PAPER NUMBER
2823	

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DATE MAILED: 10/31/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/637,094	GHYSELEN ET AL.
	Examiner	Art Unit	
	Thanh V. Pham	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>03 October 2005</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20 and 23-26* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20 and 23-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

        1.☐ Certified copies of the priority documents have been received.

        2.☐ Certified copies of the priority documents have been received in Application No. _____.

        3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1.   A request for continued examination under 37 CFR 1.114, including the fee set

forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this

application is eligible for continued examination under 37 CFR 1.114, and the fee set

forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action

has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on

10/03/2005 has been entered.

Response to Amendment

Claim Rejections - 35 USC § 102

2.   The text of those sections of Title 35, U.S. Code not included in this action can be found

in a prior Office action.

3.   Claims **1**-8, 12, **16**, **18**-20, 23-24 and 26 rejected under 35 U.S.C. 102(a) as being

anticipated by Vuong et al. US 2004/0017574 A1.

Re claim 1, the Vuong et al. reference teaches a method for adjusting the thickness of a

thin semiconductor material layer, figs. 1-2 and the associated paragraphs, which comprises:

measuring the layer [0037], e.g., to establish a thickness profile [0046], steps 330, 340

of fig. 2, e.g.;

comparing the measured thickness profile with stored standard profiles [0037], [0050],

e.g., wherein each standard profile is stored in association with respective thickness

adjustment specifications [0052], e.g.;

selecting a stored standard profile to associate said layer with the respective thickness

adjustment specification [0003], [0010], [0048] and fig. 5, e.g.; and

adjusting the thickness of said layer <u>by simultaneously treating the entire surface of said</u>

<u>layer selectively</u> in accordance with the thickness adjustment specification [0055], [0061],

[0072], [0084], [0087], [0095]-[0097], steps 380-398 of fig. 2, e.g.

Re claim 2, the thickness adjustment specifications are recipes 54, [0066], e.g.

Re claim 20, wherein the recipes correspond to at least one of uniform thickness

modification across the layer, or differential thickness modification across the layer [0075] and

figs. 12, e.g.

Re claim 3, the method which further comprises establishing association between the

stored standard profiles and the recipes [0037], fig. 3, e.g.

Re claim 4, the method further comprises establishing associations by using an

algorithm having a target specification input for thickness profile established for layer

fabrication [0086], e.g.

Re claim 5, the method further comprises using identical meshes to establish the

thickness measurements, the standard profiles, and the target specification [0039], [0040], e.g.

Re claim 6, the method further comprises automatically reactivating the configuration

algorithm on each change of target specification to establish a new configuration defining

correspondences between the standard profiles and the recipes [0086], e.g.

Re claims 7-8, the method further comprises storing at least one configuration

associated with the thickness measurement or a plurality of configurations, and selecting a

desired configuration [0091], e.g.

Re claim 12, wherein the algorithm selects categories of recipes as a function of thickness differences between the target and the standard profile to establish a configuration, without searching through all recipes [0086], [0092] and fig. 4, e.g.

Re claim 23, wherein each standard profile is stored in storing means 1850/1860 and the measured thickness profile is compared with stored standard profiles by a processor unit 1840 associated with the storing means, with the processor configured to receive measurements made on the layer from thickness measuring means 1860, and to forward thickness adjustment specifications to thickness adjustment means 1830, fig. 6A, e.g.

Re claim 24, the thickness measuring means is at least one of an ellipsometer and a reflectometer [0007], [0036], [0037], [0040], e.g.

Re claim 16, the method as of claim 1, comprises applying thickness adjustments *simultaneously* and selectively to the layer surface, wherein the adjustments differ depending on location on the layer surface, [0055], [0061], [0072], [0084], [0087], [0095]-[0097], e.g.

Re claims 18-19 and 26, the method as of claim 1 further comprises treating batches of layer, wherein one layer thickness in the batch is adjusted by a certain given pitch while a subsequent layer thickness is being measured; wherein the layers of a given batch share the same final target thickness, and the recipe for each layer is individualized to ensure that once thickness adjustment has been completed, a mean layer thickness is obtained for the batch that is as close as possible to the common target [0084]-[0086], e.g., "the regression results such as ... film thickness, and profile from the parameter selector ... may be used by a system user to fine-tune the ... fabrication process. Alternatively, the regression results may be used to adjust variables and/or physical controls of the fabrication process", [0096], figs 8-13, e.g.

Claim Rejections - 35 USC § 103

4.   The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5.   · Claims 9-11 and 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vuong et al. as applied to claims 1-8, 12, 16, 18-20, 23-24 and 26 above, and further in view of Ferrell et al. US 6,751,343 B1.

The Vuong at al. reference though teaches a method as in the above, refers to use of data-gathering criterion to test/compare whether sufficient data about the structure is available to perform the model and parameter selection [0056] and make a final selection of optimization parameters based on one or more selection criteria [0084]; although the flowchart/diagram of fig. 5 resembles a tree structure having selecting zones of the standard profile *(re claim 10)* defined by recipe parameters *(re claim 14),* provides the step 375 of fig. 2 for adjusting the profile model and/or the parameter selection criteria *(re claim 13)*, it discloses **neither** the tree structure defining categories and sub-categories with a desired number of levels *(re claim 9)*, finer and finer levels of detail *(re claim 11)*, wherein the high level categories of recipes in the recipe tree structure include: a first high level recipe category defining a uniform thickness adjustment specification for the entire surface of the layer; and additional high level categories depending on overall distribution parameters for thickness adjustment specifications over the surface *(re claim 15)* **nor** establishing a link between a starting level of a standard profile tree structure and an arrival level of a recipe tree structure, such that for each standard profile belonging to a given category of starting level there exists an arrival level category of recipes; searching for a recipe for a standard profile at the starting level by automatically directing the

search towards the arrival level category; and continuing the search by going deeper into the

recipe tree structure to establish a configuration *(re claim 13)*.

The Ferrell et al. reference teaches a system and method for indexing and retrieving

data for subsequent fast retrieval (col. 2, lines 50-52) so that a corrective action can be quickly

taken (col. 2, line 44), the tree diagram of fig. 6 depicts a hierarchical search tree for use with

the method of fig. 7 wherein defining categories and sub-categories with desired number of

levels and finer and finer levels of detail. The method "has been applied to <u>continuously</u>

<u>manufactured web products</u> such as ... thick and thin film ceramics" col. 8, lines 40-43. The

"method ... can be subdivided into two process: a method for indexing ... and a method for

retrieving, col. 5, lines 62-65. The method for indexing begins in step 10 of fig. 3A, adding

feature vector to vector list at step 18, creating node after loading next feature vector then

inserting top-down node in indexing tree (steps 28-32 in fig. 3B). Fig. 7 is a flow chart

illustrating a method for retrieving information stored in a hierarchical tree structure as in fig. 6.

wherein the search for a standard profile at the starting level by automatically directing the

search towards the arrival level category (steps 42, 44) and continuing the search by going

deeper into the recipe tree structure to establish a configuration (steps 48, 60).

It would have been obvious to one of ordinary skill in the art at the time the invention

was made to apply the hierarchical tree structure of Ferrell et al. into the library of Vuong et al.

as the tree structure would be selected in accordance with the method for adjusting the

thickness of a thin semiconductor material layer in order to index and retrieve data for

subsequent fast retrieval so that a corrective action can be quickly taken in the manufacturing

process as taught by Vuong et al.

6.   Claims 17 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Vuong et al. as applied to claim 1 above, and further in view of Wolf, Silicon

Processing for VLSI Era, vol. 1, chapter 7 and applicant's admitted prior art.

Re claim 17, the Vuong et al. reference discloses in [0075] oxide thickness as an

optimize parameter selection in a process example, "the model identification may be ..

silicon dioxide thickness", [0097], e.g. Wolf discloses "thermal oxidation of single crystal

silicon" with "tightly controlled" and "various techniques are available for measuring

oxide thickness" including "automated ellipsometry equipment", page 235. To employ

sacrificial oxidation for adjusting the layer thickness would have been obvious to one of

ordinary skill in the semiconductor coating art as the oxidation would be selected in

accordance with the thickness control after measurement and consideration of related

parameters in a method for adjusting the thickness of a thin semiconductor material

layer as taught by Vuong et al.

Re claim 25, the Vuong reference does not mention to a particular hydrogen

annealing. The applicant's admitted prior art, US 6,403,450 provide by the applicant,

teaches hydrogen annealing is "an additional step of annealing the substrate is added to

enable the layer to be cured of surface irregularities generated during oxidation and

during the preceding steps in the method of preparing the thin layer" (the instant

specification's page 25). It would have been obvious to one of ordinary skill in the art at

the time of the invention to provide the process of Vuong et al. with the known step as

taught by applicant's admitted prior art because the additional step would provide the

process of Vuong with the cure for the formed layer.

Response to Arguments

7.   Applicant's arguments filed 10/03/2005 have been fully considered but they are not

persuasive.

8.   Applicant argues that "Vuong does not selectively treat the entire surface of the layer

simultaneously, but instead uses a "profile model and parameter selection" for fabrication

cluster "feed-forward or feed-backward control loops". Vuong has no explicit mention of

changing a layer thickness according to a thickness adjustment specification, let alone by

doing this selectively and simultaneously on the entire surface of the layer." Applicant is

directed to Vuong's[0007]-[0010], [0037], [0046], e.g., wherein

> [0037] ...The diffraction beam 49 is <u>measured</u> by a metrology beam receiver 51. The
> diffraction beam data 57 is transmitted to a profile application server 53. The profile
> application server 53 <u>compares</u> the measured diffraction beam data 57 against a library
> 54 of calculated diffraction beam data representing varying combinations of critical
> dimensions of the target structure and resolution of the critical dimensions ... the library
> instance in library 54 best matching the measured diffraction beam data 57 is selected.
> [0053] when the termination criteria are met, ... regarding the fabrication, wafer site ...
> are saved in a data store.
> [0054], the results of model and parameter selection may be <u>utilized</u> in several ways. ...
> in step 398, the results of profile model and parameter selection <u>are utilized for
> fabrication cluster</u> feed-forward or feed-backward control loops. Details of this aspect
> are discussed in Fig. 6C.
> [0055] ... techniques may include structure characterization obtained <u>from</u> an integrated
> circuit <u>fabrication process</u> ...
> [0066] ... the nominal values and ranges of the geometric parameters are obtained.
> These values and ranges are typically obtained <u>from historical or test data *for* the
> fabrication process </u>or recipe. ...
> [0067] In step 540, the dependencies of the geometric parameters are defined. Again,
> the dependencies of the geometric parameters are <u>*based on* historical or test results for
> the particular fabrication process</u> of recipe. ...
> [0072] ...   Several tasks may be ***concurrently*** or *serially* <u>performed</u> to provide
> information as to whether an optimization parameter should be selected or excluded. ...

[0084] ... If an optimization parameter is not selected, then the optimization parameter is set to a fixed value, the fixed value determined from fabrication data or previous experience with the recipe. ...

[0091] FIG. 6C is an architectural diagram of a metrology model optimizer ... **in-line** requests 1931 for the same data is transmitted from an optical metrology system 1930. The optical metrology system 1930 is *coupled to* a fabrication cluster 1940, which may be a clean track unit, lithography machine, an etch machine or a combined lithography-and-etch unit. As a wafer (not shown) completes a fabrication process step, structures on the wafer are measured by the optical metrology system 1930 creating measured diffraction signals 1931 transmitted to the metrology model optimizer 1920. In addition to the critical dimension data 1924 being transmitted to the profiler workstation 1925, the same data is transmitted to the fabrication cluster 1940 for advanced process control use. The critical dimension data 1924 may be used by the fabrication cluster 1940 to adjust process variables *of the fabrication process*. The profiler workstation 1925 sends requests 1926 for critical dimensions, profiles, and film thickness of measured diffraction signals and other input data (not shown) characterizing the structures on the wafer or location of similar data stored in the metrology model optimizer 1920. The optical metrology system 1930 receives transmitted data 1941 from the fabrication cluster 1940 regarding completion of one or more fabrication processes. After completing the measurements of structures on the wafer, the optical metrology system transmits signals 1941 to the fabrication center 1940 to indicate completion of optical metrology measurements.

[0096] ... results may be used to adjust variables and/or physical controls of the fabrication process. ...the profile model and optimization parameters selected may be used to create a library of simulated signals and associated profile data.

The thickness of a film in process is also mentioned to in many paragraphs amongst several examples, [0046], [0064], [0075], e.g.

It is clearly that the above passages are equivalent with the instant invention steps of measuring, comparing, selecting and adjusting and doing this selectively and simultaneously on the entire surface of the layer in a method for adjusting the thickness of a thin semiconductor material layer not just "profile model and parameter selection" for fabrication cluster "feed-forward or feed-backward control loops" as alleged (the Remark's page 7, fourth paragraph) and therefore the Vuong reference does not distinct from the claimed instant invention.

9.   In response to applicant's argument on the rejection under 103(a), the response to

Vuong's is as in the above. Wolf is used to employ sacrificial oxidation for adjusting the layer

thickness that mentioned by Vuong and Ferrell is used for "a hierarchical search tree for use

with the method wherein defining categories and sub-categories with desired number of levels

and finer and finer levels of detail" and further, the method "has been applied to continuously

manufactured web products such as ... thick and thin film ceramics" col. 8, lines 40-43 wherein

the tree structure of Vuong is modified and made clear although, in Vuong, the

flowchart/diagram of fig. 5 resembles a tree structure having selecting zones of the standard

profile defined by recipe parameters, provides the step 375 of fig. 2 for adjusting the profile

model and/or the parameter selection criteria.

Conclusion

10.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure.

11.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time

policy as set forth in 37 CFR 1.136(a).

        A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the mailing date of this final action.

12.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Thanh V. Pham whose telephone number is 571-272-

1866. The examiner can normally be reached on M-T (6:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number

for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

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For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).

10/24/2005

George Pourson
Primary Examiner